

ADM300 Survey Meter

Radiological Assessment Kits

9235984B

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The information in this document describes the product as accurately as possible, but is subject to change without notice.

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CHAPTER 1 INTRODUCTION

1.1 GENERAL INFORMATION

1.1.1 SCOPE

The purpose of this manual is to explain the operation of the ADM300 multi-function system consisting of the ADM300 survey meter and probes. The ADM300 has been packaged with several sets of probes known collectively as ADM300 Kit.

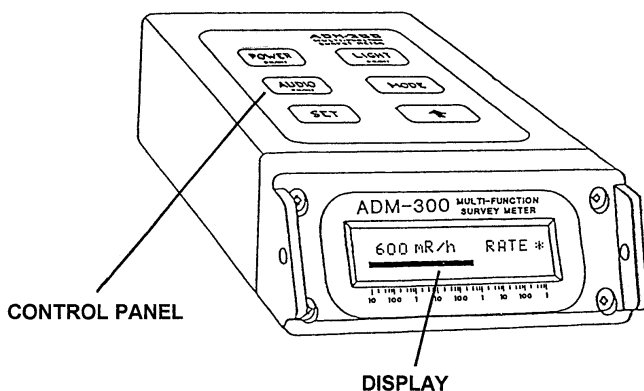
MANUAL TYPE: Operator's manual

MODEL/EQUIPMENT NAME: ADM300 Multi-function survey meter

DESCRIPTION/CAPABILITIES OF EQUIPMENT:

The ADM300 is a battery operated, self diagnostic, multiple functional instrument used alone to locate and measure low and high intensity radioactivity in the form of gamma rays or beta particles, or used with external probes to locate and measure alpha, beta, gamma, x-ray, and neutron radiation.

ADM300 Survey Meter



ADM300 MAJOR COMPONENTS

SURVEY METER

Sensors, electronics, controls, indicators, batteries.

Survey Meter Functions:

Sense and display Dose, Dose rate, provide necessary indications.

DISPLAY

LCD panel with switchable back light.

Display Functions:

Show dose rate, accumulated dose, low batteries condition, alarm set points, test and fault indicators.

CONTROL PANEL

Membrane switch panel.

Control Panel Functions:

Provide operator's input for normal use and for test of the instrument.

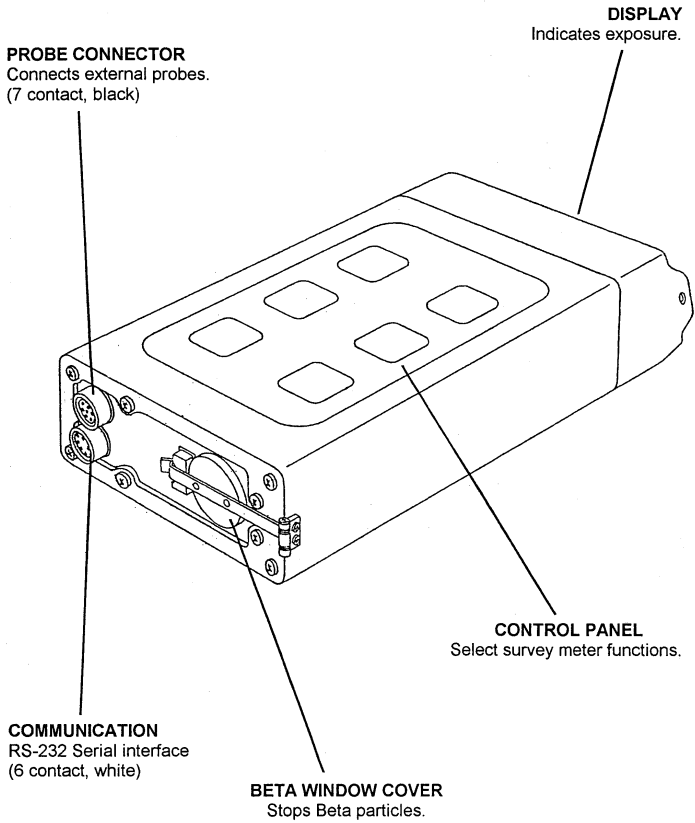
SOFTWARE/EPROM VERSION

The processor's program which controls the functions and modes of the ADM300 survey meter is controlled by two socketed EPROM IC(s) in the meter.

EPROM VERSION VERIFICATION

The EPROM version (date) can be verified using the ADM300 keypad during power up. With the survey meter OFF, press and hold the SET and AUDIO button while pressing the POWER ON/OFF button. The display will indicate "date: mm/dd/yy" with EPROM version's month/day/year shown in the mm/dd/yy field. Releasing the buttons returns the ADM300 normal operation.

SURVEY METER



1.1.2 NOMENCLATURE CROSS REFERENCE LIST

Common names are used when the major components of the set are mentioned in this manual.

COMMON NAME	OFFICIAL NOMENCLATURE
ADM300	Multi function survey meter
Alpha probe	AP100A
Alpha / Beta probe	ABP100
Beta probe	BP100
X-ray probe	XP100
Carrying case	Case, ADM300
Strap	Strap, ADM300

1.1.3 LIST OF ABBREVIATIONS AND ACRONYMS

Acronyms are defined the first time they appear in this manual. A list of abbreviations and acronyms follows.

uR	micro-Roentgen (1 uR = 0.001mR) (1 mR = 1000uR)
mR	milli-Roentgen (1mR = 100uR) (1R = 1000mR)
R	Roentgen
KR	kilo-Roentgen (1kR = 1000R)
mR/h	milli-Roentgen per hour
LCD	Liquid crystal display
G-M	Geiger-Mueller tube
cpm	Counts per minute
uCi/MxM	Micro-Curie per square meter
DPM/CMxCM	Disintegrations per minute per (100) square centimeters

1.1.4 GLOSSARY

DOSE RATE	An amount of radiation exposure within a given period of time. (uR/h, mR/h, R/h, or kR/h)
DOSE	A cumulative amount of radiation exposure. (uR, mR, R, or kR)
DECADE	Range of values 10 times larger or smaller than an adjacent range.
GAMMA RAY	Electromagnetic radiation of high energy and ultra short wavelength (high penetration).
BETA PARTICLES	Negatively charged particles moving at high (low penetration).
X-RAYS	Electromagnetic radiation of high energy having a shorter wavelength than those in the ultraviolet region (low penetration).
AUTO RANGING	The survey meter display will automatically provide the proper readings and units over its entire operating range without the need for mechanical switching or other operator actions.

1.2. EQUIPMENT DESCRIPTION AND DATA

1.2.1 ADM300 EQUIPMENT DESCRIPTION

CHARACTERS

- Lightweight
- Easy to use
- Operates from internal replaceable batteries
- AC power source or vehicular power
- Self-testing during operation
- Auto-ranging
- Accepts external probes

CAPABILITIES

- Detects, measures, and digitally displays levels of gamma radiation dose rate from 10 uR/h to 10,000 R/h. The analog display covers 10 uR/h to 1000 R/h.
- Detects and displays relative level of beta particles.
- Measures, stores, and digitally displays accumulated dose from 1 uR to 10,000 R. The analog display covers 10 uR to 1000 R.

FEATURES

- Liquid crystal display (LCD) shows three digits, decimal point and unit of measure for dose rate/count rate or accumulated dose. Also indicates low batteries and faults.
- External probe attachment for increased and/or remote monitoring.
- Can be vehicle powered and mounted.
- Audible and/or visual alarm independently settable for dose rate and accumulated dose.
- RS-232 Serial computer port.

Note: Shown is a typical ADM300 case layout, actual case layout may vary.

1.2.2 ADM300 EQUIPMENT DATA

ENVIRONMENTAL

Altitude transportation	10,000 m (32,808 ft)
Altitude operating range	To 4,572 m (15,000 ft) Above sea level
Humidity	0 to 95%
Operating temperature	-30 °C to +50 °C (-22 °F to 122 °F)
Storage temperature	-40 °C to +60 °C (-40 °F to 140 °F)
Water resistance	Splash proof and momentary immersion proof.

OPERATIONAL

Detectors: Two G-M detectors (low-range for gamma and beta radiation, high-range only for gamma radiation) located internally, facing the rear panel of the instrument

Range:

Low-range detector (Dose rate) 10 uR/h to 5 R/h

High-range detector (Dose rate) 3 R/h to 10,000 R/h

OVER ALL DETECTING RANGE

Dose rate: 10 uR/h to 10, 000 R/h for gamma rays.
10 uR/h to 5 R/h for Beta radiation.

Accumulated dose: 1 uR to 1,000 R

ACCURACY

Dose rate: $\pm 15\%$ up to 10,00 R/h.

Dose: $\pm 15\%$ up to 1000 R.

Linearity: $\pm 5\%$

Response time Two to five second.

ALARMS Audio and visual.

WEIGHTS AND DIMENSIONS (SURVEY METER)

Weight 1.36 kg (3 lb).

Height 4.8 cm (1.88 in.)

Width 11.1 cm (4.38 in.)

Length 21.6 cm (8.50 in.)

POWER

Main power (all weather) 9V. Two standard 9 volt batteries.
(Holder parallels batteries, only one required for operation)

Vehicle power (when vehicle mounted) 12 to 24

AC Power	Supplies 9 V dc Input: 100 to 240 V ac 50 or 60 Hz.
----------	---

Main power (battery life)	100 hours typical.
---------------------------	--------------------

1.2.3 AP100 EQUIPMENT DATA

Alpha radiation detection probe.

Range	0 CPM - 1,200,000 CPM
Weight	0.91 kg (2 lb)
Dimensions	12.7 x 30.5 x 8.9 cm (5 x 12 x 3.5 in.)

1.2.4 XP100 EQUIPMENT DATA

X-ray radiation detection	17 keV window (Pu-239).
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Weight	0.91 kg (2 lb)
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Dimensions	2.4 in. diameter x 10 in. long.
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Nominal background reading	200 CPM
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1.2.5 ABP100 EQUIPMENT DATA

ENVIRONMENTAL / MECHANICAL

Operating temperature	20.9 °C to 49 °C (−20 °F to 120 °F)
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Enclosure:	Aluminum, shock and vibration protected, quick replacement mylar windows
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OPERATIONAL

Active Area	100 cm ²
Window Thickness	0.6 mg/cm ²
Sensitivity	Alpha: 4 μCi/100cm ² (250 dpm/100 cm ²) Beta: 17 μCi/100 cm ² (1,000 dpm/100 cm ²)
Gamma Response	0.12 cps per mR/h (alpha channel) 0.50 cps per μR/h (beta channel)
Uniformity	± 20% (with 1 inch diameter source)
Scintillation	Dual phosphor plastic/ Zns (Ag)

Efficiency	TYPE	SOURCE	SIZE	EFFICIENCY (2 π)
	Alpha	U-238	2 in.	38%
	Alpha	Am-241	2 in.	48%
	Alpha	Pu-239	2 in.	45%
	Alpha	Pu-239	large area	48%
	Beta	Sr-90	point source	30.7%
	Beta	Cs-137	point source	55%
	Beta	Co-60	point source	30%

ALARMS: None

WEIGHTS AND DIMENSIONS:

Weight 14.1 kg (31 lb)
Dimensions 34.3 x 17.8 x 10.9 cm (13.5 x 7 x 4.3 in.)

POWER:

Main Power +5 V dc from ADM300

1.2.6 CC100 CARRY CASE DATA

Weight: Empty 3.6 kg (8 lb)
ADM300 Kit A 8.2 kg (18 lb)
ADM300 Kit B 4.9 kg (11 lb)
ADM300 Kit C 7.7 kg (17 lb)
Dimensions: 53.3 x 39.6 x 12.7 cm (21 x 15 x 6.5 in.)

1.2.7 CSP100 COMPUTER SOFTWARE PROGRAM

Optional computer program used to monitor and control the ADM300 remotely, download survey entries to screen and disk, remote ADM300 calibration, etc. The program is not required for calibration. It allows personnel to stand away from the calibration source while controlling the calibration procedure from a safe distance. The program is not required to view the survey entries. However, multiple survey entries can be monitored more easily and saved for later retrieval.

CHAPTER 2

OPERATING INSTRUCTIONS

2.1 DESCRIPTION OF CONTROLS AND INDICATORS

2.1.1 EQUIPMENT CONTROLS AND INDICATORS

2.1.1.1 MEMBRANE SWITCHES

POWER

Turns unit On or Off when pressed for at least two seconds.

LIGHT

Turns LCD backlight.
On or Off.

AUDIO

Turns audio On or Off.

MODE

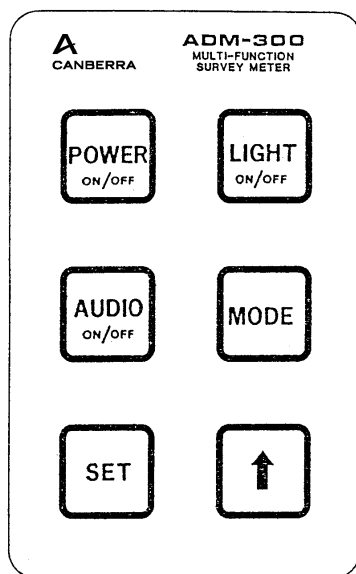
Displays available modes.

SET

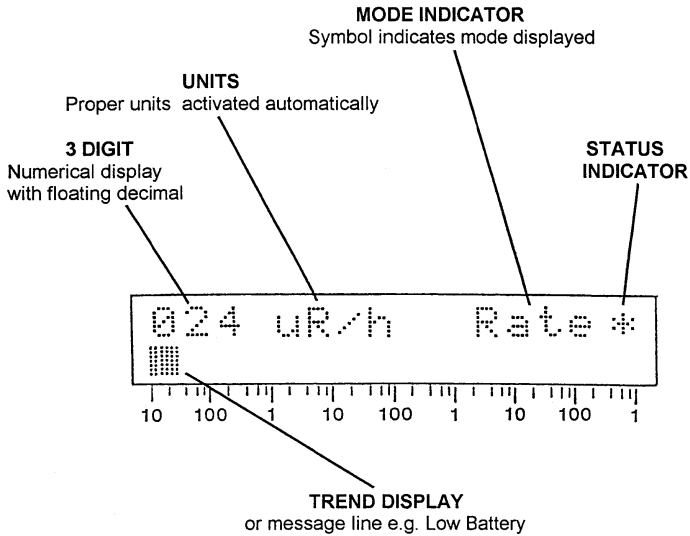
Used to enter modes and adjust alarms set points.

↑:

Called INC for increment. Used to adjust alarm set points, clear dose, and select other available rate displays.



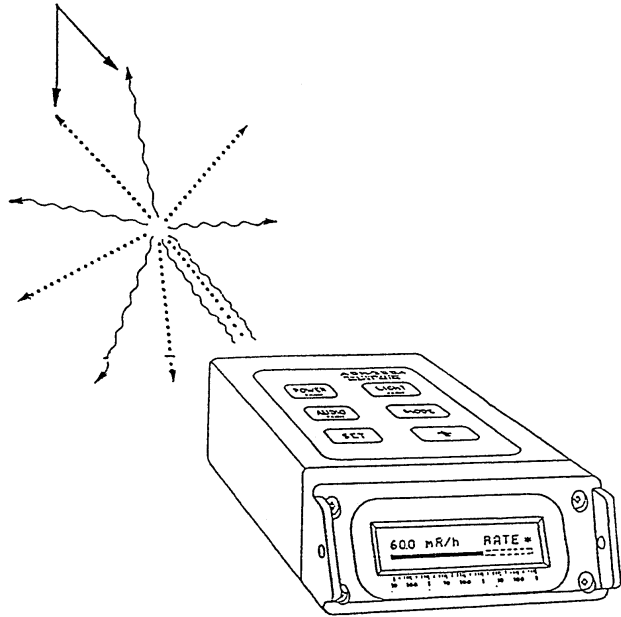
2.1.1.2 DIGITAL DISPLAY



<u>MODE</u>		<u>STATUS</u>	
<u>OPERATING MODE</u>	<u>MODE INDICATOR</u>	<u>SYSTEM STATUS</u>	<u>STATUS INDICATOR</u>
Dose Rate	Rate	Normal (Audio Enabled)	*
Dose	Dose	Normal (Audio Disabled)	(Blank)
Rate Alarm	RaAlm	Rate Alarm	R (Flashing)
Dose Alarm	DoAlm	Dose Alarm	D (Flashing)
		Both Rate & Dose	B (Flashing)

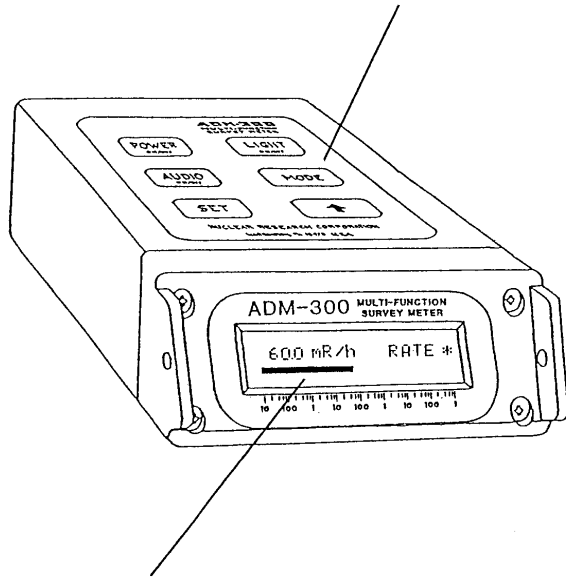
2.1.1.3 PRINCIPLE OF OPERATION

1. Gamma rays and beta particles from radioactive source travel in all directions.



2. Two G-M detectors in the survey meter produce electrical signals when exposed to gamma rays and beta particles.
3. Survey meter converts signals into dose rates and accumulated dose; activates alarm when preset alarm levels are exceeded.

- Control panel switches permit operator to set alarm levels for audible or visual display, select display readings and perform equipment tests.



- Display shows dose rate and accumulated dose values, alarm set levels, battery conditions and test and fault indicators.

2.2 OPERATION

2.2.1 EQUIPMENT APPLICATIONS

There are three methods used to locate radiological contamination: Surveying, Monitoring, and Ground radiological reconnaissance.

MONITORING

Monitoring is performed to detect and determine the presence (or absence) of radiation and, if present, the intensity of the radiation.

- Area monitoring is performed initially and then periodically or continuously to provide early warning and useful radiological data.
- Personnel, equipment and other resources are monitored to detect radiological contamination.

SURVEYING

Surveys are conducted to find the extent and intensity levels of radiological contamination. There are two types, aerial and ground.

Note: To perform aerial surveys, auxiliary equipment is required which is not supplied with the ADM300.

- Aerial surveys cover a large area faster than other methods. They are more flexible, require fewer personnel and minimize exposure.
- Ground surveys offer a higher degree of accuracy and can be performed in any type of weather and in darkness.

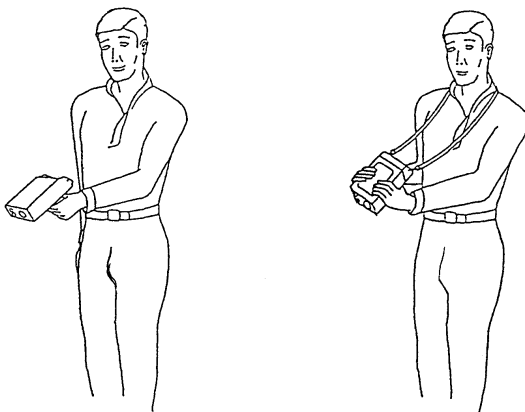
GROUND RADIOLOGICAL RECONNAISSANCE (GRR)

GRR is the process of detecting radiation and measuring it before a unit moves into or through an area.

Note: When the ADM300 is vehicle mounted, a power converter module available to utilize vehicle power.

2.2.1.1 SURVEY AND MONITORING MODES

In the survey or monitoring modes the operator wears the survey meter using the shoulder carrying strap. The ADM300 must be held in at a consistent angle to assure accuracy and uniformity of readings. If the Gun Handle is used, the survey meter can be held more comfortably.



2.2.1.2 GAMMA SURVEY

The beta window cover located on the rear panel of the ADM300 must be closed when measuring gamma radiation. Detection is provided by both low-range and high-range detectors located in the unit. The survey meter auto-ranges from low to high and high to low range smoothly and without interruption.

2.2.1.4 BETA MONITORING

CAUTION



The beta window can be ruptured by sharp objects. Use extreme care to protect the beta window when the beta window cover is open for monitoring beta radiation.

The ADM300 is intended for beta radiation detection only. The dose rate indicated is not accurate for beta radiation.

When monitoring for beta radiation, the unit must be hand held, and the beta window cover must be open and pointed towards the beta radiation to allow beta particles to enter the window of the low range detector. Only the low range detector is capable of detecting beta particles.

Beta radiation is detected by comparing the displayed reading with the beta window open to the reading with the beta window closed. If the beta window open reading is greater, then beta radiation is present. Note: the Survey mode can be used to derive accurate average readings for comparison.

2.2.1.4 ALPHA MONITORING

Alpha monitoring will normally be performed with the alpha probe in close proximity to, or directly on, the surface being monitored.

2.2.1.5 X-RAY MONITORING

X-ray monitoring will normally be performed with the x-ray probe in close proximity to the surface being monitored.

2.2.2 OPERATIONAL TEST EXPLANATION

The ADM300 is self testing and the pre-operational tests are performed automatically by the equipment, indicating malfunctions on the display if they occur. Note: Refer to operator maintenance, chapter 3, for malfunctions discovered during operation.

2.2.2.1 AUTOMATIC TEST

SELF-TEST

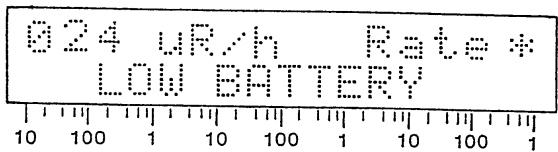
The ADM300 is self tested continuously during operation. The tests include main battery condition, counting and timing sequences, internal circuitry, voltage and detectors. During power on sequencing, the ADM300 will check its RAM and EPROM memories. A "Backup RAM error" is expected if the batteries have been

removed. This is a non-critical message. However, alarm set points will have to be reset if the default values are not desired.

LOW BATTERY INDICATOR

If testing detects a low battery condition, the message line display indicates "LOW BATTERY". From the time of the initial indication of a low battery, approximately ten hours of useful battery life remain.

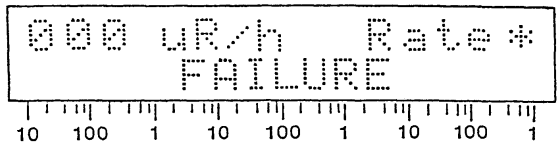
**LOW BATTERY
INDICATOR**



Note: When LOW BATTERY is displayed, use the "LIGHT" as little as possible and replace the batteries at the first opportunity (see section 2.2.1).

GENERAL FAULT INDICATOR

To indicate problems other than low batteries discovered during automatic testing, the general fault indicator (FAILURE) is displayed.



If the ADM300 displays the failure indicator during operation, immediately turn the unit OFF and return to maintenance for repair.

DELAYED GENERAL FAULT INDICATOR

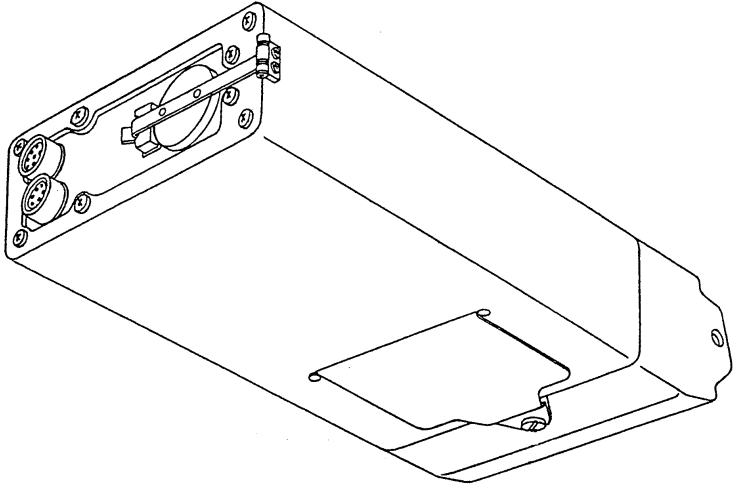
For low-range detector failure, the general fault indicator (FAILURE LOW RANGE) is displayed. In the event of any "Failure" display, turn the unit OFF and have the unit returned to maintenance.

2.2.3 OPERATING PROCEDURES

2.2.3.1 BATTERY INSTALLATION

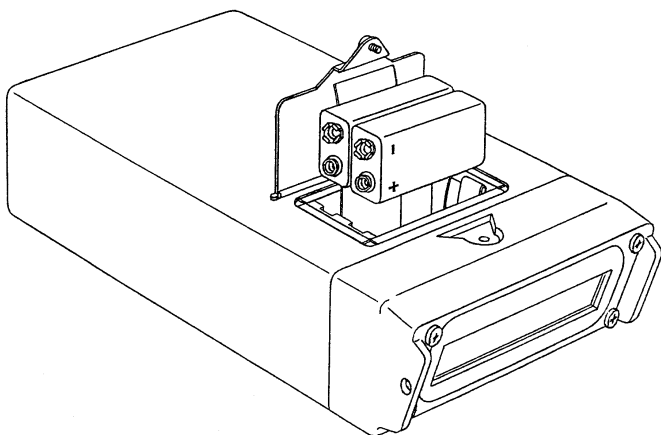
Note: Only one battery required for operation. Two battery operation recommended.

1. Be sure the ADM300 is turned OFF (display blank).



2. Loosen, but do not remove captive screw.

3. Open battery well cover and remove two batteries by pulling on the battery compartment pull tab.

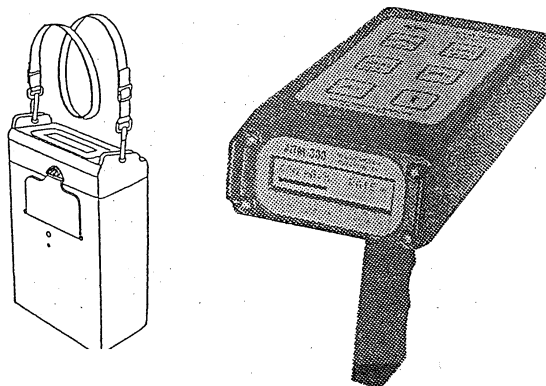


4. With pull tab pushed back into battery compartment, insert new batteries (two) into the battery box using the directional label located inside the battery compartment. Insert positive terminal first as indicated.
5. Replace well cover and tighten captive screw.

CAUTION: DO NOT OVER TIGHTEN

2.2.3.2 ATTACHING CARRYING STRAP

Attach the strap clip to the survey meter front panel mounting holes with the spring clips, located at each end of the strap.



Note: Remove the strap when storing the ADM300 in the carrying case.

2.2.3.3 ATTACHING GUN HANDLE / PISTOL GRIP

Place the captive screw of the handle over the tapped hole in the bottom of the instrument such that the handles peg aligns with the round depression in the instrument case.

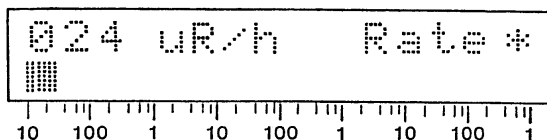
Start the captive screw into the tapped hole in the case while seeing that the peg fits in the hole. Hand tighten the screw firmly with the knurled screw head.

2.2.34 TURNING THE UNIT ON

Press and hold POWER ON/OFF switch for *two seconds* to turn unit ON.

The display indicates "PLEASE WAIT" and then conducts a automatic test. On successful completion of the self-test, the "RATE" display will appear and ambient gamma dose rates will be indicated. The ADM-300 updates the display every two seconds.

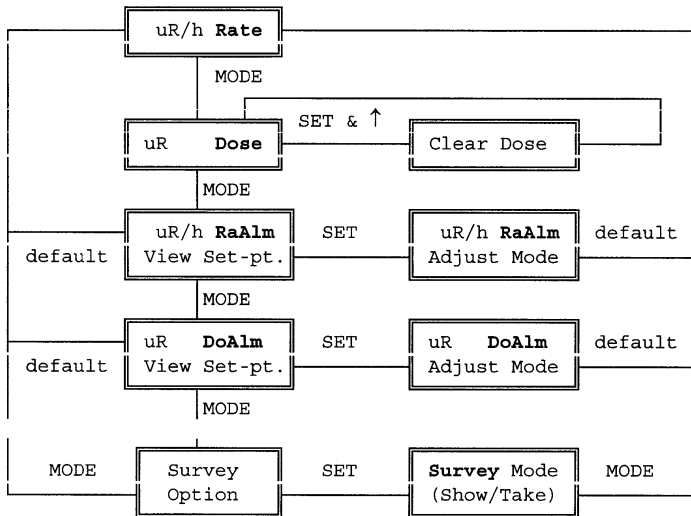
Note: A "Backup RAM Error" message will be indicated if the ADM300 has been stored with the batteries removed. The default alarm values will be installed. The accumulated DOSE is unaffected.



Sample Rate Display

See section 2.1.1, Equipment Control and Indicators, for display explanation.

Note: The bar scale is displayed for eight decades only. The bar scale is useful only in the observation of quick trends of radiation intensity and is not suited for accurate readings. The digital scale should be used for accurate readings.



ADM300 alone/no probe displayed function flow diagram

2.2.35 ILLUMINATE DISPLAY

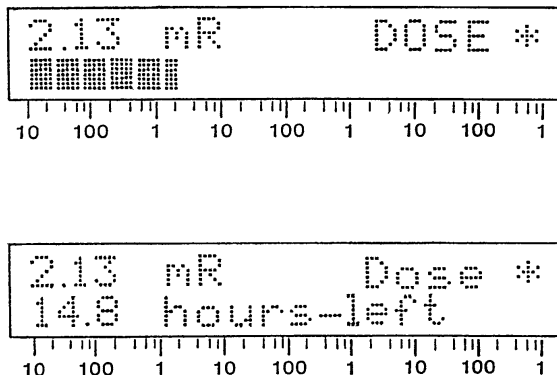
CAUTION

Use of the display light will drain the batteries.

With the unit is turned ON, press and release the **LIGHT ON/OFF** switch to turn the display back light ON or OFF. The back light is turned off automatically after two minutes to preserve battery life.

2.2.3.6 DISPLAY ACCUMULATED DOSE

Press and release the MODE switch as often as necessary until "DOSE" is displayed. The value shown is the total accumulated Dose since the dose was last reset/zeroed. In the DOSE display mode, the bottom line will indicate (flash) the time remaining at the current dose rate until the dose alarm set point is exceeded if that time is less than 24 hours.



Sample Accumulated Dose Displays

Example: 10.0 mR Dose Alarm Set point in a 530uR/h Field

2.2.3.7 DISPLAY ALARM SET POINTS

To see the current Alarm Set Points, press and release the MODE switch until "RaAlm" (Rate Alarm) or "DoAlm" (Dose Alarm) is displayed. For RaAlm, the displayed Rate Alarm point reading will flash several times and then the display will return to Rate display. For DoAlm, the flashing Dose Alarm setting will also change to the Rate display.

When the batteries are removed for more than a few minutes, the rate and dose alarm set points revert to the default (factory) settings. The default rate alarm point is 600 uR/h and the default dose alarm point is 100 mR.

Turning the survey meter OFF and ON will not affect the current alarm point settings. With the batteries installed, the unit's memory will retain the last set values, even with the power OFF.

If the batteries are removed for more than several minutes, a battery backed RAM error will be displayed and the default alarm settings will be reinstalled.

Note: Accumulated dose will *not* be lost when batteries are removed.

2.2.3.8 ADJUST ALARM SET POINTS

To change the alarm set points, select the desired RaAlm (Rate Alarm) or DoAlm (Dose Alarm) display.

Before the display stops flashing, press and release the SET switch. The measurement unit (ex: uR) will now flash. Pressing and releasing the "up arrow" will change the measurement unit through ten decade steps. Stop the switch depressions when the desired decade is displayed.

Each of the three numerical digits in the display can now be individually changed or accepted. Pressing the SET switch, the high order digit in the display starts flashing. This digit can be changed if desired, by successive depressions of the "up arrow". When the desired number is reached, it is accepted by depressing the SET switch.

This action also shifts the selection process to the next digit position, where the same process allows setting this digit to the desired value. The third digit can also be set in the same manner.

When all digits have been entered, the display returns to the display of Rate. The new (if changed) values of alarm points can be verified by pressing the MODE switch until the alarm values are displayed.

2.2.39. RESET / ZERO ACCUMULATED DOSE

To reset Accumulated Dose, press and release the MODE button until DOSE is displayed. Next, press and hold SET. While holding SET, press and hold INC (up arrow) for at least three seconds. The reading will begin to flash, then "Clear Dose" will be displayed. The Dose value will reset to zero, and the "Clear Dose" display will disappear. Release all switches.

2.2.3.10 SET / ENABLE AUDIO

Press the AUDIO switch to turn this function ON and OFF. The ON state provides audible count signals and audible alarms for both Dose and Dose Rate. The ON state is indicated by a displayed asterisk (*).

Note: When the unit is powered on initially, the sounder will only emit an audible tone when an alarm set point is exceeded. Individual counts or "clicks" will not be heard until the sounder is disabled and re-enabled.

2.2.3.11 ALARM DISPLAY

When the survey meter has detected radiation above the alarm levels that were set, an audible and a flashing visual alarm are produced. Alarm levels for accumulated Dose and for Dose Rate are independently detected. The display shows the type of alarm, which can be:

R = RATE ALARM

D = DOSE ALARM

B = BOTH RATE & DOSE ALARMS

The audible alarm will not sound if the Audio function is disabled.

Note: Alarm indicators will flash and continue to be displayed until the alarm condition disappears *and* the alarm is acknowledged by the operator pressing any button (except power).

2.2.3.12 SURVEY MODE

The ADM300 survey meter can be used to make multiple survey entries and view these entries later or down load them to a computer using the ADMCOM software package. The survey mode is only available with the ADM300 alone or when it has an external probe that reads in dose rate not count rate. For example, the external gamma probe and neutron probe have survey mode available. In the Survey mode, the ADM300 measures the average dose rate. The period over which the average is measured is determined by an algorithm that will automatically terminate when sufficient data has been accumulated for a statistically accurate reading of $\pm 10\%$ accuracy at a 99% confidence level, 660 counts. This feature allows for accurate readings, while minimizing exposure to the operator.

The Survey mode is menu driven from the bottom line of the ADM300 display. The Survey mode is entered by pressing and releasing the MODE switch until the display indicates "To enter Survey Push → SET." Press the SET button to enter the Survey mode. The ADM300 now asks the user to select the TAKE_Survey option by pressing SET or to select the SHOW_Survey option by pressing the INC (up arrow) button.

During the SHOW_Survey function, the bottom line indicates the available commands such as:

INC→ Next Entry	display the next survey location entry
SET → Last Entry	display the last survey location entry
MODE → Exit Survey.	exits survey mode and returns display to Rate mode.

During the TAKE - Survey function, the user has two options.

1. Keep or Zero the old (existing) survey entries.

SET→ KEEP old

INC → ZERO old

2. User/Keypad or Bar Code Reader location entry.

SET → Use BarCode

INC → NO BarCode.

2.2.3.13 SCALER MODE

The Scaler mode provides a useful summing function for count rate probes over a user selectable period. This allows accurate objective recording to be made of samples without any mental averaging of displayed count rates by the operator. For example, if smear samples from a suspected contaminated area are to be evaluated, a one minute scaler could be made of each smear sample. Although the Scaler mode is available for dose rate probes and the ADM300 alone, the dose indication provides the same function.

2.2.3.14 TURNING THE UNIT OFF

Press and hold POWER ON/OFF switch for two seconds to turn the unit OFF.

Note: When the survey meter is turned OFF with batteries still installed, the previously set alarm values are unaffected, and are restored unchanged when the power is turned ON.

Note: ADM300 Kits A AND C contain external probes. Follow procedures in section 2.2.5, External Probe Operation, for applicable probes.

2.2.3.15 STORAGE

Remove accessories such as handle, carrying strap, and probe cable from ADM300. Remove batteries from ADM300 if unit will be inactive for more than a month. Place all units and accessories in the carrying case.

2.2.4 OPERATION IN HARSH WEATHER

Characters on the display will form at a slower rate in temperatures below -10°C . The survey meter automatically compensates for this delay by sensing temperatures below -10°C . and reducing the display refresh time from every two seconds to every five seconds. Operation of the set is normal otherwise.

2.2.5 EXTERNAL PROBE OPERATION

External probes for Alpha, Beta, Gamma, X-ray, and Neutron monitoring are available. Each external probe is configured such that during power-up of the survey meter, the type of probe is recognized electronically by the survey meter. The ADM300 provides power to operate the probe.

External probes are connected to the survey meter through the 7-pin connector on the back panel while the ADM300 is turned OFF.

The survey meter *must* be turned OFF before connecting the external probe to the survey meter. After connection, when the survey meter is turned ON, the meter automatically gets all the necessary configuration and calibration data from the probe. Since each probe contains its own calibration information, any probe can be used with any ADM300 and maintain its calibration.

The up arrow (\uparrow) INC button is used to switch the rate display to other available units. Note: Rate Alarm and other functions are not available for all probes.

Note: When an external probe is attached, the internal detectors are de-activated; the accumulation of dose is suspended; and the alarm set points are inactive. The "-002" ADM300 version allows monitoring of the internal GIVI tube dose rate.

2.2.5.1 ALPHA PROBE, AP100A

1. With the survey meter turned OFF, connect the probe cable to the 7-pin connector on the probe and the other end of the cable to the ADM300 7-pin connector.
2. Turn the survey meter power ON. The unit displays "Please Wait" then "ALPHA PROBE" and units of measurement appear. The unit automatically begins to measure Alpha radiation.

Note: If the unit does not indicate probe is attached or if a light leak in the Mylar window is suspected, refer to Chapter 3, *Operator Maintenance*, for trouble shooting procedures.

3. To monitor Alpha radiation remove the protective cover, place the probe window toward the contamination source.

4. Three units of alpha measurement are available:

0.000 cpm (counts per minute).

0.000 uCi/m x m (micro-Curie per square meter).

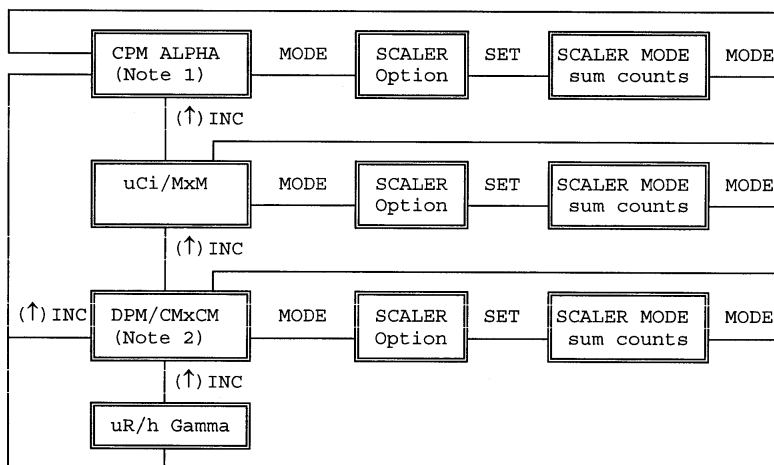
0.000 DPM/cm x cm (disintegrations per minute
per 100 square centimeter*)

(*100 square centimeters implied, but not shown)

Press INC (↑) to sequentially select from available alpha displays. Refer to the Alpha probe's functional flow diagram for available modes.

Note: Pressing and releasing the SET button will zero the displayed rate and empty the digital count rate filter.

5. Press and release AUDIO to activate the sounder as desired.
6. Turn off ADM300, replace protective cover, and disconnect probe.



Notes:

- 1: Adjusted counts per minute. Probe efficiency adjusted.
- 2: Micro-Curie per 100 square centimeter.
- 3: Press and release SET button to zero displayed rate.

AP100A Alpha Probe Displayed Function Flow Diagram

2.2.5.2 BETA PROBE, BP100

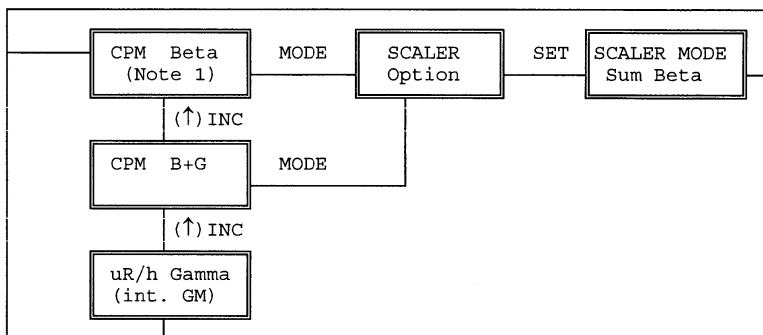
1. With the survey meter turned OFF, connect the probe cable to the 7-pin connector on the probe and the other end of the cable to the ADM300 7-pin connector.
2. Turn the survey meter power ON. The unit displays "Please Wait", "BETA PROBE", then displays units of measurement. The unit automatically begins to measure Beta radiation.

Note: If the unit does not indicate probe is attached, refer to Chapter 3, *Operator Maintenance*, for trouble shooting procedures.

3. To monitor Beta radiation, point the probe window toward the contamination source.
4. The Beta Probe provides automatic background Gamma compensation by means of the ADM300's internal low-range G-M tube.
5. Gamma compensation can be de-activated. Press and release the INC (↑) switch until "B+G" is displayed to show that both Beta and Gamma are being counted. Press and release INC until Beta is displayed to reactivate Gamma compensation.

Refer to the Beta probe's functional flow diagram for available modes.

6. Press and release AUDIO to activate the sounder as desired.
7. Turn off ADM300 and disconnect probe.



Note 1: Beta rate derived from $(B+G) - K(\text{int. GM})$.

BP100 Beta Probe Displayed Function Flow Diagram

2.2.5.3 GAMMA PROBE, BGP100

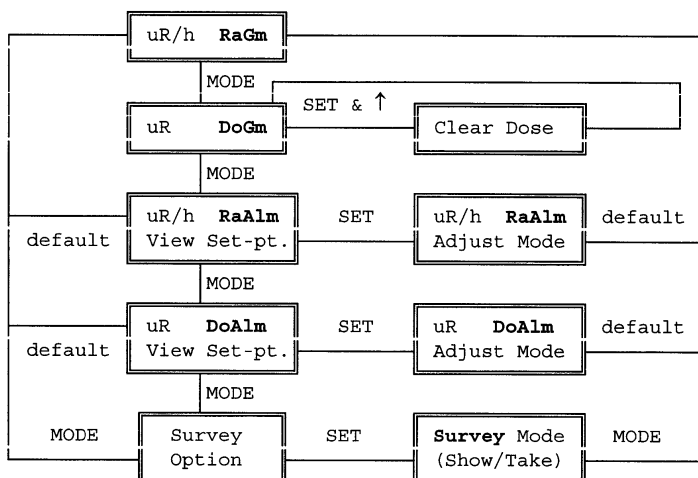
1. With the survey meter turned OFF, connect the probe cable to the 7-pin connector on the probe and the other end of the cable to the ADM300 7-pin connector.
2. Turn the survey meter power ON. The unit displays "Please Wait", then units of measurement. "RaGm" (Rate Gamma) is shown in place of the usual "Rate" to indicate that an external gamma probe is attached.

Note: If the unit does not indicate probe is attached, refer to Chapter 3, *Operator Maintenance*, for trouble shooting procedures.

The unit begins to monitor Gamma radiation using the external probe.

The two internal G-M tubes are de-activated in this configuration. Refer to the Gamma probe's functional flow diagram for available modes.

3. Press and release AUDIO to activate the sounder as desired.
4. Turn off ADM300 and disconnect probe.



BGP100 Gamma probe displayed function flow diagram

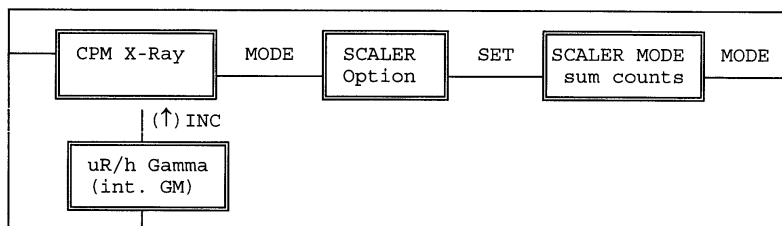
2.2.5.4 X-RAY PROBE, XP100

1. With the survey meter turned OFF, connect the probe cable to the 7-pin connector on the probe and the other end of the cable to the ADM300 7-pin connector.
2. Turn the survey meter power ON. The unit displays "Please Wait", "X-RAY probe", then units of measurement.

Note: If the unit does not indicate probe is attached, refer to Chapter 3, *Operator Maintenance*, for trouble shooting procedures.

Refer to the X-ray probe's functional flow diagram for available modes.

3. To monitor X-ray radiation, point the probe window toward the suspected source.
4. Press and release AUDIO to activate the sounder as required or desired.
5. Turn off ADM300 and disconnect probe.



XP100 X-Ray Probe Displayed Function Flow Diagram

2.2.2.5 NEUTRON PROBE, NP100

1. With the survey meter turned OFF, connect the probe cable to the 7-pin connector on the probe and the other end of the cable to the ADM300 7-pin connector.
2. Turn the survey meter power ON. The unit displays "Please Wait", "Neutron Probe", then display units of measurement.

Note: If the unit does not indicate probe is attached, refer to Chapter 3, *Operator Maintenance*, for trouble shooting procedures.

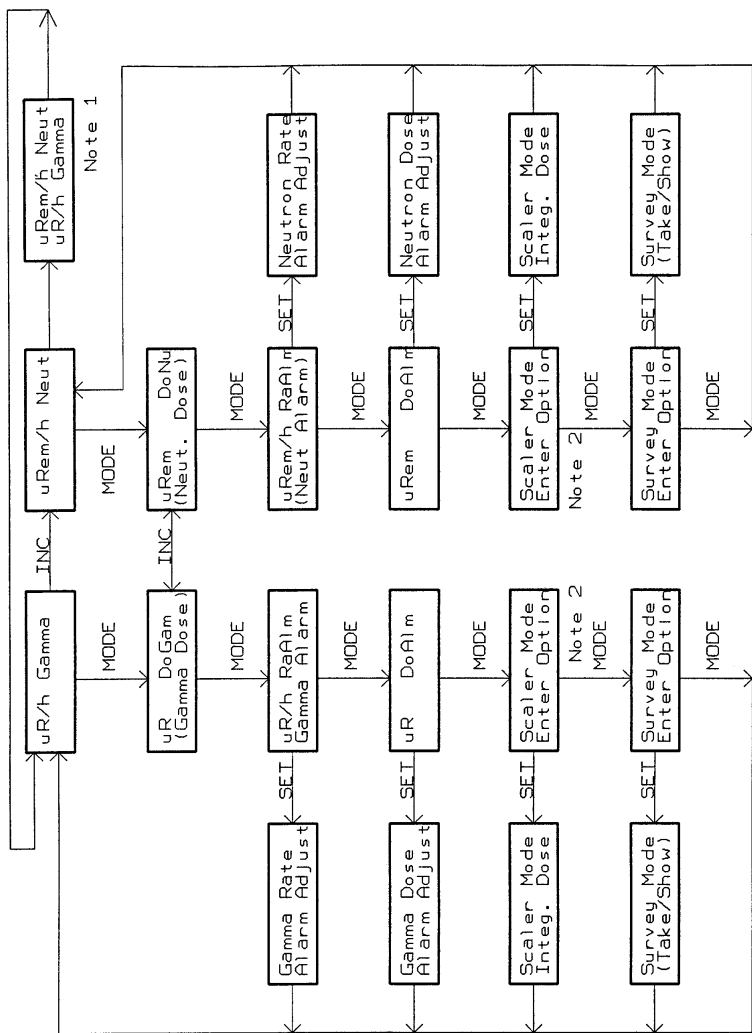
The unit begins to measure Neutron radiation.

Refer to the Neutron probe's functional flow diagram for available modes.

3. Press and release AUDIO to activate the sounder as desired.

Note: The ADM300 internal low range GM tube is still active with the Neutron probe. Press and release the INC (↑) button to toggle between neutron displays and gamma displays. See flow diagram below.

4. Turn off ADM300 and disconnect probe.



NOTES: 1) Available only on 702454-002 version ADM-300A.
2) Scaler Mode disabled on 702454-002 version ADM-300A

NP100 Neutron Probe Display Function Flow Diagram

2.2.5.6 ALPHA/BETA PROBE, ABP100

1. With the survey meter turned OFF, connect the probe cable to the 7-pin connector on the probe and the other end of the cable to the ADM300 7-pin connector.
2. Turn the survey meter power ON. The unit displays "Please Wait" then "ALPHA-BETA PROBE" and units of measurement appear. The unit automatically begins to measure Alpha and Beta radiation.

Note: If the unit does not indicate probe is attached, refer to Chapter 3, *Operator Maintenance*, for trouble shooting procedures.

3. To monitor Alpha and Beta radiation remove the protective cover, place the probe window toward the contamination source.
4. To select between the available alpha and beta rate measurement units use the (↑) button.

Refer to the alpha / beta probe functional flow diagram for available modes.

5. Two units of alpha rate measurement are available.

0.000 cpm (counts per minute)

0.000 $\mu\text{Ci}/\text{m} \times \text{m}$ (micro-Curie per square meter)

The alpha cps value indicated is true counts per second, not probe efficiency adjusted.

$\mu\text{Ci} / \text{m} \times \text{m}$ are for up to five alpha isotopes: Th-232, Ra-226, Am-241, U-238, and Pu-239.

When $\mu\text{Ci} / \text{m} \times \text{m}$ readings are required for other isotopes the indicated Alpha $\mu\text{Ci} / \text{m} \times \text{m}$ readings must be scaled according to the isotope.

Example: For U-241 (efficiency 38%)

$$\text{Indicated uCi/m} \times \text{m} \times \frac{Pu-239 \text{ eff}}{U-238 \text{ eff}} = \frac{U-238}{uCi / m \times m}$$

$$\text{Indicated uCi/m} \times \text{m} \times \frac{45}{50} = \frac{Am-241}{uCi / m \times m}$$

See section 1.2.5, Alpha/Beta Probe Equipment Data, for additional alpha isotope efficiencies.

6. Two units of Beta rate measurement are available.

CPM (counts per minute)

0.000 uCi/m x m (micro curie per square meter)

uCi/m² are up to four Beta isotopes: Sr-90, Pm-147, C-14, Tc-99.

When uCi/m² readings are required for other isotopes, the indicated Beta uCi/m² readings must be scaled according to the isotope.

Example: for C-14 (efficiency 0.9%)

$$\text{Indicated uCi/m}^2 \times \frac{Sr-90 \text{ eff}}{C-14 \text{ eff}} = \text{C-14 uCi/m}^2$$

$$\text{Indicated uCi/m}^2 \times \frac{30.7}{0.9} = \text{C-14 uCi/m}^2$$

2.2.6 ALTERNATE POWER SOURCES

Batteries in the battery case are the normal source of power for the Survey Meter and its accessories. Alternate power sources are available. They are:

1. Instead of the batteries, the Survey Meter can receive power from CV100 converter which is plugged into a 120 V ac outlet. With the batteries removed from the battery case of the meter, this converter's output provides power to the Meter via a connector that mates with the communication port.
2. Another converter module, this one for vehicular use, is also available. This module operates on input of 12 to 24 V dc and provides the 9 V dc needed by the Survey Meter. It connects to the Meter as described in step "1" above.

CHAPTER 3 OPERATOR MAINTENANCE

3.1 PREVENTIVE MAINTENANCE

Preventive maintenance consists of routine checks of the equipment before and after each mission and at least every 180 days. Routine checks include cleaning, dusting, and storing items not in use.

Problems requiring maintenance discovered during routine checks should be referred to maintenance.

3.2 ROUTINE MAINTENANCE CHECKS

- Ensure batteries are removed.
- Check membrane switch for cracks and breaks.
- Check ADM300 probe and communications connectors to insure that contacts are free of foreign material.
- Check probe cable connectors to insure that pins are straight and free of foreign material.
- Check the beta window for damage, holes, dirt, and moisture.
- Remove dust, moisture and loose dirt from the outside surfaces of the ADM300 with a clean soft cloth.
- Check for broken display window.
- Inspect the battery well gasket for damage. Replace as required.
- Inspect the battery contacts. Remove any corrosion, using a pencil eraser.

CAUTION: The ADM300 Beta window cover should be in its closed position before placing in carrying case.

- Check carrying strap for cracks and breaks.
- Check all probes to insure that connector contacts are free of foreign material.
- Remove grease, fungus, and ground-in dirt from the carrying case.
- Check EM-100 connector pins and ear piece to insure that pins are straight and free of foreign material.

3.3 TROUBLESHOOTING PROCEDURES

In the event that a problem occurs during the operation of the ADM300, the following list of symptoms and corrective actions should be observed:

1. Display is blank when unit is turned ON. Install new batteries (see section 2.2.3.1, Battery Installation).
2. Improper or no alarm indications during normal operation. Check and/or reset alarm points.
3. Display alternates between high and low reading.

Two possible causes: Defective high-range tube or the Beta cover is open and the low-range tube is responding to Beta radiation in excess of 5 R/h. This is a normal condition.

Note: The high-range tube is not sensitive to Beta radiation and in the second condition above, the low-range tube is receiving radiation above its rated value.

When the display alternates between high and low, the operator should close the Beta shield if it is open. The alternating condition should stop. If it continues, the high-range tube is defective. In this event, the ADM300 set should be referred to maintenance.

4. ADM300 fails to recognize external probe. Make sure that ADM300 is turned OFF before probe was attached. Inspect connectors for foreign material and make sure cable pins are straight.

If fault remains, try connecting another probe, if available, to the ADM300. If no fault is observed, return original probe to maintenance. If a fault still exists, try another probe cable, if available.

The inspections, tests, and corrective actions listed should be performed. If normal operation cannot be restored, or if the observed malfunction symptom is not on the list, return for maintenance.

3.4 AP100A MYLAR WINDOW REPLACEMENT PROCEDURES

When an AP100A is attached to the ADM300, an increase in the displayed rate, when the protective cover is removed, indicates a probable light leak through the Mylar window of the AP100A. The larger the light leak, the greater the increase in counts. A gross leak caused by a tear or large hole in the Mylar window will sometimes cause the ADM300 to display zero counts. The Mylar window only needs to be replaced if a light leak is present.

3.3.1 LIGHT LEAK VERIFICATION

To verify the existence of a light leak compare the displayed count rate with the Mylar window protective cover in place to that with the cover removed. A higher reading with the protective cover removed indicates a light leak in the Mylar window. This verification procedure should be performed under well lit conditions. Sunlight or a bright light will work well. Do not allow the light or any hot object get close to the Mylar window, or damage may result.

The displayed count rate will vary due to the statistical nature of radiation. The scaler mode can be used to make more accurate and objective readings. The Mylar window and cover can be further protected from the light for the initial reading by the use of an opaque cloth or material.

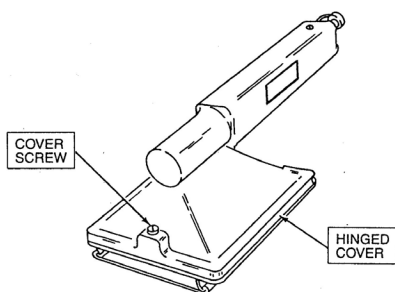
3.4.2 MYLAR WINDOW REMOVAL PROCEDURE

CAUTION

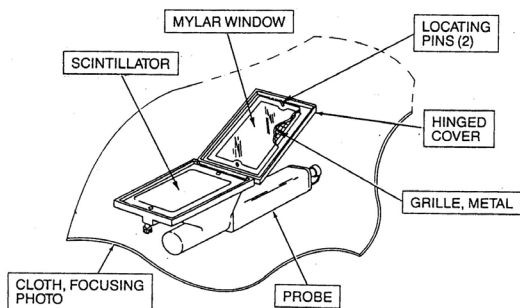


Exposing the photomultiplier tube to bright light can cause damage to the tube. The following procedures must be performed beneath a cloth light shield, or in a darkened area, to avoid tube damage.

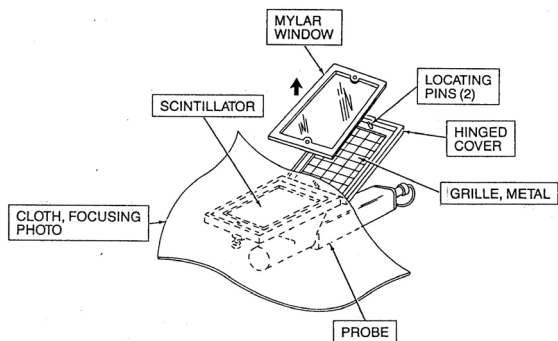
1. To remove the AP100A alpha probe Mylar window, turn the ADM300 OFF and disconnect the AP-100A.
2. Loosen the captive thumb screw in the AP-100A housing assembly, and then invert the probe so that the hinged cover is facing up.



3. With the probe inverted completely cover the probe with a cloth light shield and open the hinged cover.



4. Move the cloth light shield so as to view just the Mylar window and not the scintillator which covers the photomultiplier tube.



5. Remove the Mylar window with the light leak.
6. Install new Mylar window into the hinged cover and onto locating pins with the frame side of the window facing down when placed on the grill.
7. Close hinge cover with the light shield covering the scintillator surface.
8. Slide the cloth light shield out until clear, and tighten captive screw securely hand tight.

CHAPTER 4: PERFORMANCE TEST

4.1 SYSTEM CHECK

The ADM300 survey meters and probes, if available, should be checked prior to use and at least every 180 days for accuracy to assure maximum confidence levels and preparedness.

4.2 ACCURACY VERIFICATION PROCEDURE

4.2.1 ABP100 VERIFICATION PROCEDURE

1. A Thorium-232 source is permanently attached to the ABP100 probe cover to verify the probe operation.
2. With the ADM300 turned OFF, attach the ABP100 and turn ON the ADM300. Press and release the INC (↑) until "cps Alpha" is displayed.
3. Make sure the probe cover is well seated with the Thorium-232 facing the alpha sensitive area.
4. Allow the reading to settle for approximately 20 seconds. Observe that the displayed Alpha cps rate reading is above the background reading.
5. Press and release the INC (↑) until "cps Beta" is displayed
6. Allow the reading to settle for approximately 20 seconds. Observe that the displayed Beta cps rate reading is above the background reading.
7. Turn ADM300 OFF and disconnect the ABP100.

4.2.1 ADM300 VERIFICATION PROCEDURE

Equipment requirement:

- GCF200 Test Fixture
 - TS-100 Test Sources
 - Consisting of container, Cs-137 button source, and Th-232 fixture.
 - Note: Verify Cs-137 source serial number matches that on the test source container lid.
1. Prepare the GCF200 Test Fixture by inserting the Cs-137 source face-up in the circular inset indicated for testing the ADM300.
 2. Refer to the illustration in the ADM300 Kit E (Test/Verification Kit) manual or on the source container lid and place the ADM300 Survey Meter in position on the test fixture as shown.

3. Turn the ADM300 ON and verify that Rate is displayed. Allow the rate reading to settle for 20 seconds. Observe the displayed Rate reading.
4. Observe that the displayed rate reading is between the upper and lower limits listed for the current year and correct probe/unit on the expected readings label on the inside lid of the TS100 container.
5. If the reading is not within the indicated limits, repeat steps 1 - 4. If the reading still fails to fall within the listed limits, return unit to maintenance.
6. Turn ADM300 off and return Cs-137 source to the TS-100 container.

4.2.3 AP100A VERIFICATION PROCEDURE

1. Remove the Th-232 fixture from the TS100 test source container. Close and move the TS100 with Cs-137 button a few feet away.
2. With the ADM300 turned OFF attach the AP100A and turn on the ADM-300. Press and release the INC (↑) until "cpm Alpha" is displayed. Remove the protective cover from the AP100A window.
3. Refer to illustration in the ADM300 Kit E (Test/Verification Kit) manual or on the Th-232 source fixture and place the Th-232 fixture in position on the AP100A window as shown. Make sure that the Th-232 source is facing the AP100A window.
4. Allow the rate reading to settle for approximately 20 seconds. Observe that the displayed rate reading is between the upper and lower limits listed for the current year and correct probe in the expected readings column on the Th-232 fixture label.
5. If the reading is not within the indicated limits, repeat steps 1 - 4. If the reading still fails to fall within the listed limits, return unit to maintenance.
6. Turn ADM300 off, replace the AP100A protective cover, disconnect the AP100A, and return Th-232 source to the TS100 container.

4.2.4 BP100 VERIFICATION PROCEDURE

1. Prepare the GCF200 Test Fixture by inserting the Cs-137 source face-up in the circular inset indicated for testing the BP100.
2. Refer to illustration in the ADM300 Kit E (Test/Verification Kit) manual or on the source container lid and place the BP100 in position on the test fixture as shown.
3. Turn the ADM300 ON. Press and release INC (↑) until B+G is displayed. Observe the displayed Rate reading.
4. Allow the rate reading to settle for approximately 20 seconds. Observe that the displayed rate reading is between the upper and lower limits listed for the current year and correct probe/unit on the expected readings label on the inside lid of the TS100 container.
6. If the reading is not within the indicated limits, repeat steps a - d. If the reading still fails to fall within the listed limits, return unit to maintenance.
7. Turn ADM300 off, disconnect the BP100, and return Cs-137 source to the TS100 container.

4.2.5 BGP100 VERIFICATION PROCEDURE

1. Prepare the GCF200 Test Fixture by inserting the Cs-137 source face-up in the circular inset indicated for testing the BGP100.
2. Refer to illustration in the ADM300 Kit E (Test/Verification Kit) manual, or on the source container lid, and place the BGP100 in position on the test fixture as shown.
3. Turn the ADM300 ON and verify that RaGm is indicated for external gamma probe rate. Allow the rate reading to settle for approximately 20 seconds. Observe the displayed rate reading.
4. Observe that the displayed rate reading is between the upper and lower limits listed for the current year and correct probe/unit on the expected readings label on the inside lid of the TS100 container.
5. If the reading is not within the indicated limits, repeat steps 1 - 4. If the reading still fails to fall within the listed limits, return unit to maintenance.
6. Turn ADM300 off, disconnect the BGP100, and return Cs-137 source to the TS100 container.

4.2.6 XP100 VERIFICATION PROCEDURE

1. Remove the Th-232 fixture from the TS100 test source container. Close and move the TS100 with Cs-137 button a few feet away.
2. With the ADM300 turned OFF attach the XP100 and turn on the ADM300.
3. Refer to illustration in the ADM300 Kit E (Test/Verification Kit) manual or on the Th-232 source fixture and place the XP100 on Th-232 fixture in the circle indicated. The XP100 probe face should be flat against the source.
4. Allow the rate reading to settle for approximately 20 seconds. Observe that the displayed rate reading is between the upper and lower limits listed for the current year and correct probe in the expected readings column on the Th-232 fixture label.
5. If the reading is not within the indicated limits, repeat steps 1 - 2. If the reading still fails to fall within the listed limits, return unit to maintenance.
6. Turn ADM300 off, disconnect the XP100, and return Th-232 source to the TS100 container.

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Warranty

Canberra (we, us, our) warrants to the customer (you, your) that for a period of ninety (90) days from the date of shipment, software provided by us in connection with equipment manufactured by us shall operate in accordance with applicable specifications when used with equipment manufactured by us and that the media on which the software is provided shall be free from defects. We also warrant that (A) equipment manufactured by us shall be free from defects in materials and workmanship for a period of one (1) year from the date of shipment of such equipment, and (B) services performed by us in connection with such equipment, such as site supervision and installation services relating to the equipment, shall be free from defects for a period of one (1) year from the date of performance of such services.

If defects in materials or workmanship are discovered within the applicable warranty period as set forth above, we shall, at our option and cost, (A) in the case of defective software or equipment, either repair or replace the software or equipment, or (B) in the case of defective services, reperform such services.

LIMITATIONS

EXCEPT AS SET FORTH HEREIN, NO OTHER WARRANTIES OR REMEDIES, WHETHER STATUTORY, WRITTEN, ORAL, EXPRESSED, IMPLIED (INCLUDING WITHOUT LIMITATION, THE WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE) OR OTHERWISE, SHALL APPLY. IN NO EVENT SHALL CANBERRA HAVE ANY LIABILITY FOR ANY SPECIAL, EXEMPLARY, PUNITIVE, INDIRECT OR CONSEQUENTIAL LOSSES OR DAMAGES OF ANY NATURE WHATSOEVER, WHETHER AS A RESULT OF BREACH OF CONTRACT, TORT LIABILITY (INCLUDING NEGLIGENCE), STRICT LIABILITY OR OTHERWISE. REPAIR OR REPLACEMENT OF THE SOFTWARE OR EQUIPMENT DURING THE APPLICABLE WARRANTY PERIOD AT CANBERRA'S COST, OR, IN THE CASE OF DEFECTIVE SERVICES, REPERFORMANCE AT CANBERRA'S COST, IS YOUR SOLE AND EXCLUSIVE REMEDY UNDER THIS WARRANTY.

EXCLUSIONS

Our warranty does not cover damage to equipment which has been altered or modified without our written permission or damage which has been caused by abuse, misuse, accident, neglect or unusual physical or electrical stress, as determined by our Service Personnel.

We are under no obligation to provide warranty service if adjustment or repair is required because of damage caused by other than ordinary use or if the equipment is serviced or repaired, or if an attempt is made to service or repair the equipment, by other than our Service Personnel without our prior approval.

Our warranty does not cover detector damage due to neutrons or heavy charged particles. Failure of beryllium, carbon composite, or polymer windows, or of windowless detectors caused by physical or chemical damage from the environment is not covered by warranty.

We are not responsible for damage sustained in transit. You should examine shipments upon receipt for evidence of damage caused in transit. If damage is found, notify us and the carrier immediately. Keep all packages, materials and documents, including the freight bill, invoice and packing list.

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